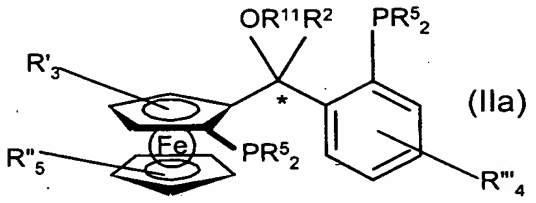
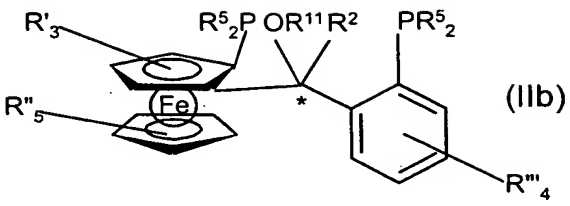
Claims:

1. A ferrocenyl ligand of the general formula (II)



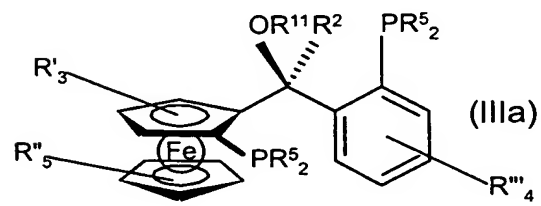
(IIa)



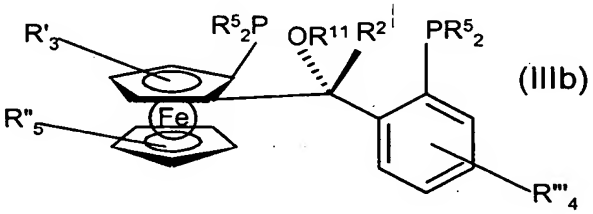
(IIb)

characterized in that

the S_{fc},S enantiomer of the formula (IIIa) is present in excess in the stereoisomer mixture (IIa) or the R_{fc},R enantiomer of the formula (IIIb) is present in excess in the stereoisomer mixture (IIb)



(IIIa)



(IIIb)

and

R' and R" are radicals which can be selected independently from the group consisting of H and CH_3 or can be a linker which connects the ligands to a polymeric support and the radicals

R"' are radicals which can be selected independently from the group consisting of H and (C_1-C_4)-alkyl and the radicals

R^5 can be, independently of one another, radicals selected from the group consisting of C_6-aryl, C_5-C_6-cycloalkyl, adamantyl and C_1-C_4-alkyl, where the radicals R^5 may bear one or more (C_1-C_4)-alkyl substituents and

R^2 is hydrogen or a (C_1-C_4)-alkyl radical and

R^{11} is a (C_1-C_4)-alkyl radical.

2. The ferrocenyl ligand as claimed in claim 1, characterized in that
R^{11} is a methyl radical and/or
R^2 is H or a methyl radical and/or
R', R", R"' are hydrogen radicals and/or the radicals
R^5 are, independently of one another, phenyl, tolyl or xylyl radicals.

3. The ferrocenyl ligand as claimed in either claim 1 or 2, characterized in that the S_{fc},*S* enantiomer or the R_{fc},*R* enantiomer is present in the stereoisomer mixture in a proportion of over 60%.

4. The ferrocenyl ligand as claimed in any of claims 1 to 3, characterized in that the ligand is present as S_{fc},*S* enantiomer or as R_{fc},*R* enantiomer having a purity of over 99%.

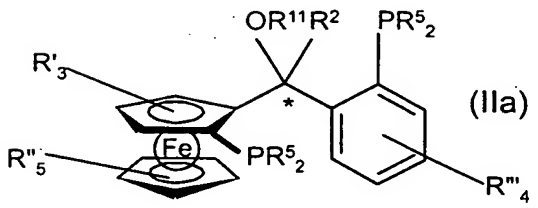
5. The use of ferrocenyl ligands as claimed in any of claims 1 to 4 for preparing complexes.

6. The use of ferrocenyl ligands as claimed in claim 5 for preparing complexes with metals, metal salts or metal precomplexes of transition group 7 or 8.

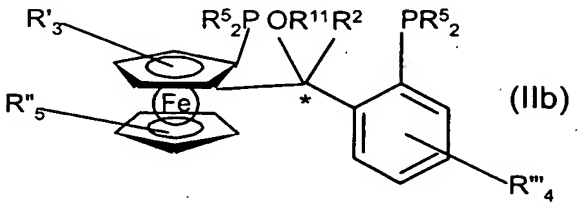
7. The use of ferrocenyl ligands as claimed in any of claims 1 to 4 in the asymmetric hydrogenation or hydroformylation of unsaturated organic compounds.

8. The use of ferrocenyl ligands as claimed in claim 7 in the asymmetric hydrogenation of C=C, C=O or C=N bonds.

9. A process for preparing ferrocenyl ligands of the general formula (II)

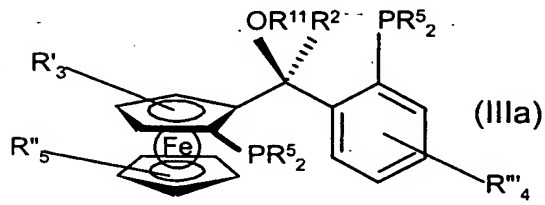


(IIa)

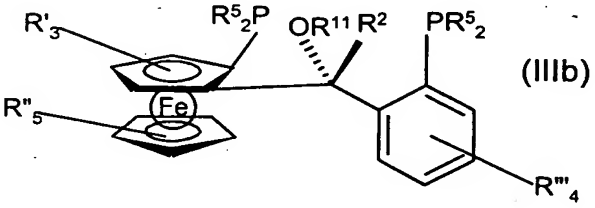


(IIb)

where the S_{fc},S enantiomer of the formula (IIIa) is present in excess in the mixture (IIa) or the R_{fc},R enantiomer of the formula (IIIb) is present in excess in the mixture (IIb)



(IIIa)



(IIIb)

and

R' and R" can each be, independently of one another, a substituent selected from the group consisting of H and (C_1-C_4)-alkyl or a linker which connects the ligands to a polymeric support and the radicals

R"' are radicals which can be selected independently from the group consisting of H, (C_1-C_{18})-alkyl, (C_1-C_{18})-alkoxy, (C_1-C_{18})-acyloxy, (C_6-C_{14})-aryl, (C_3-C_{18})-heteroaryl, (C_2-C_{17})-heteroalkyl, (C_3-C_8)-cycloalkyl and (C_2-C_{10})-alkenyl, where two adjacent radicals may also be joined to one another to form a ring system, and the radicals

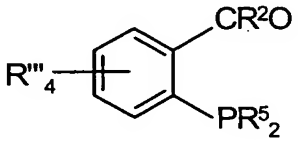
R^5 can each be, independently of one another, (C_1-C_{18})-alkyl, (C_6-C_{18})-aryl, (C_6-C_{18})-aryl-(C_1-C_8)-alkyl, (C_3-C_{18})-heteroaryl, (C_3-C_{18})-heteroaryl-(C_1-C_8)-alkyl, (C_2-C_{17})-heteroalkyl, (C_3-C_8)-cycloalkyl, (C_3-C_8)-cycloalkyl-(C_1-C_8)-alkyl, (C_2-C_{10})-alkenyl radicals which may bear one or more (C_1-C_4)-alkyl substituents and the radical

R^2 is H or a (C_1-C_8)-alkyl radical, (C_6-C_{18})-aryl, (C_6-C_{18})-aryl-(C_1-C_8)-alkyl radical and the radical

R^{11} can be a (C_1-C_{18})-alkyl, (C_6-C_{18})-aryl, (C_6-C_{18})-aryl-(C_1-C_8)-alkyl radical,

which comprises the process steps:

a) coupling of a chiral ferrocenyl sulfoxide with an aromatic aldehyde of the formula (IV),



(IV)

with the chiral ferrocenyl sulfoxide being lithiated in the presence of a lithium base and the coupling of the aromatic aldehyde subsequently being carried out by transmetallation in the presence of a metal catalyst of transition group 8,

b) coupling of the free OH group on the chiral center of the reaction product from step a) with an organic radical R^{11} by addition of the corresponding halide R^{11}Hal in the presence of an alkali metal hydride and

c) replacement of the sulfoxide group of the reaction product from step b) in the presence of a strong lithium base by a phosphorus halide of the formula HalPR^5_2.

10. The process as claimed in claim 9, characterized in that the diastereomers obtained from step a) and/or the diastereomers from step b) are separated prior to being reacted further.